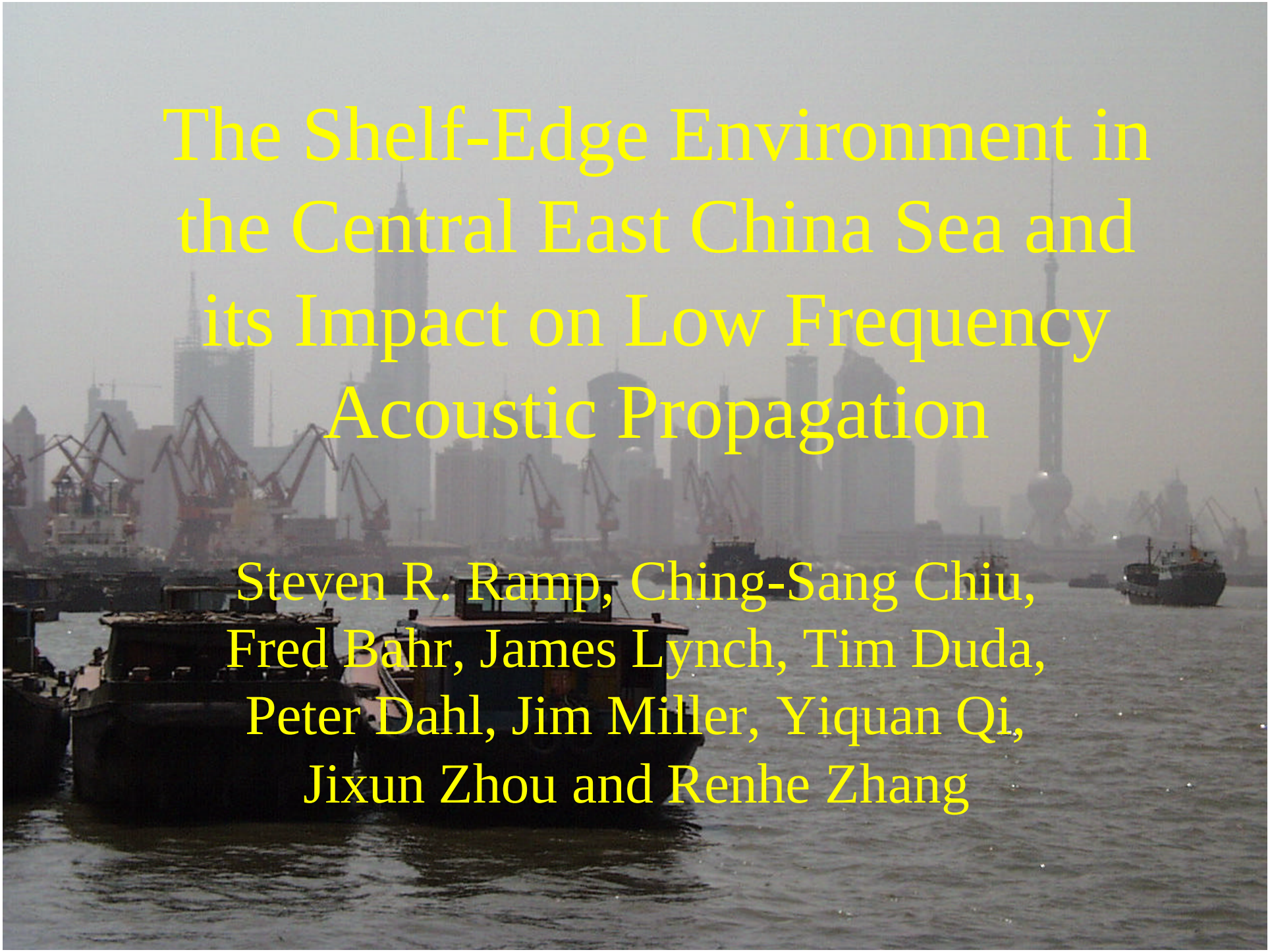

The Shelf-Edge Environment in the Central East China Sea and its Impact on Low Frequency Acoustic Propagation

Steven R. Ramp, Ching-Sang Chiu, Fred Bahr, James Lynch, Tim Duda, Peter Dahl, Jim Miller, Yiquan Qi, Jixun Zhou and Renhe Zhang

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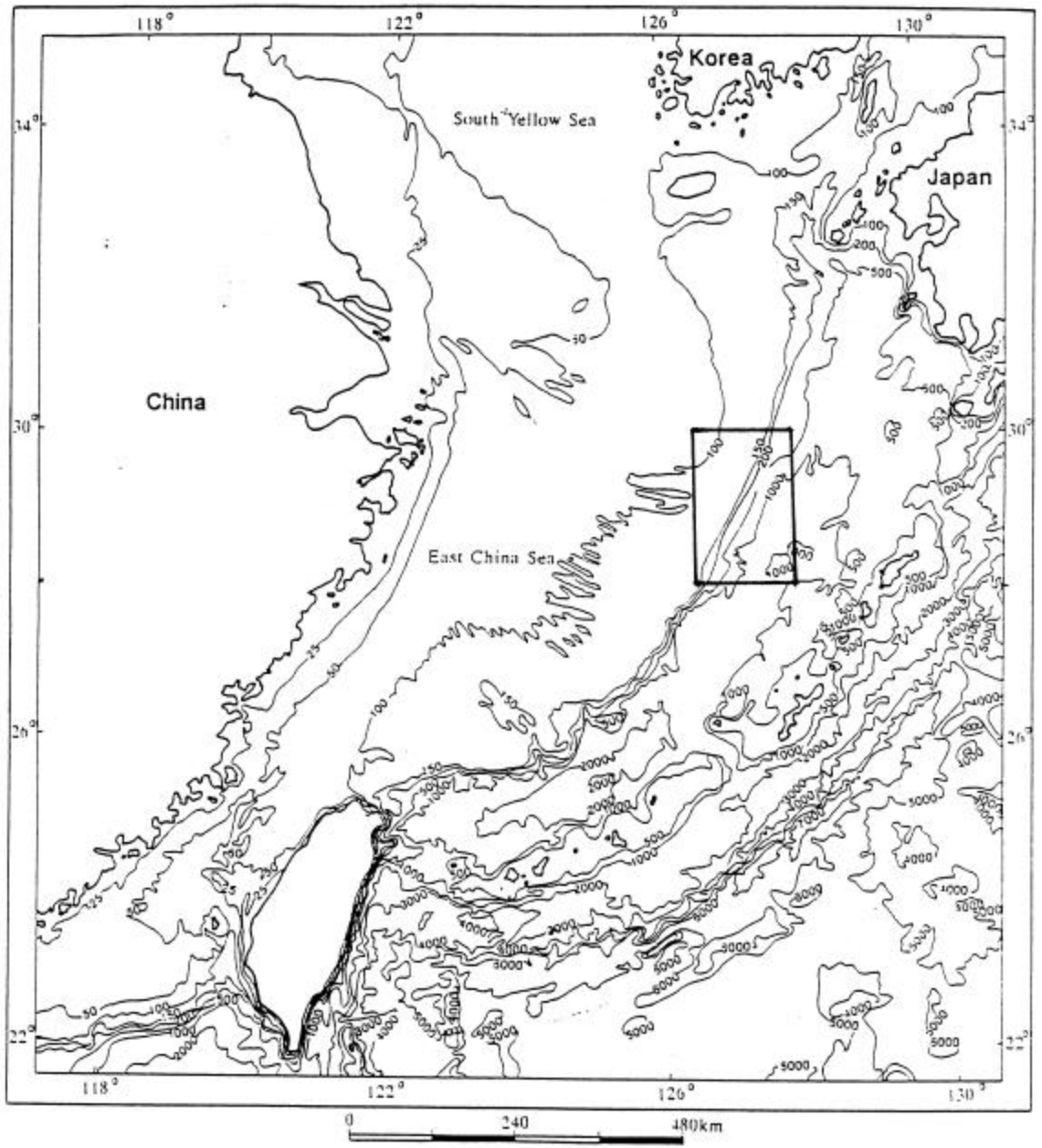
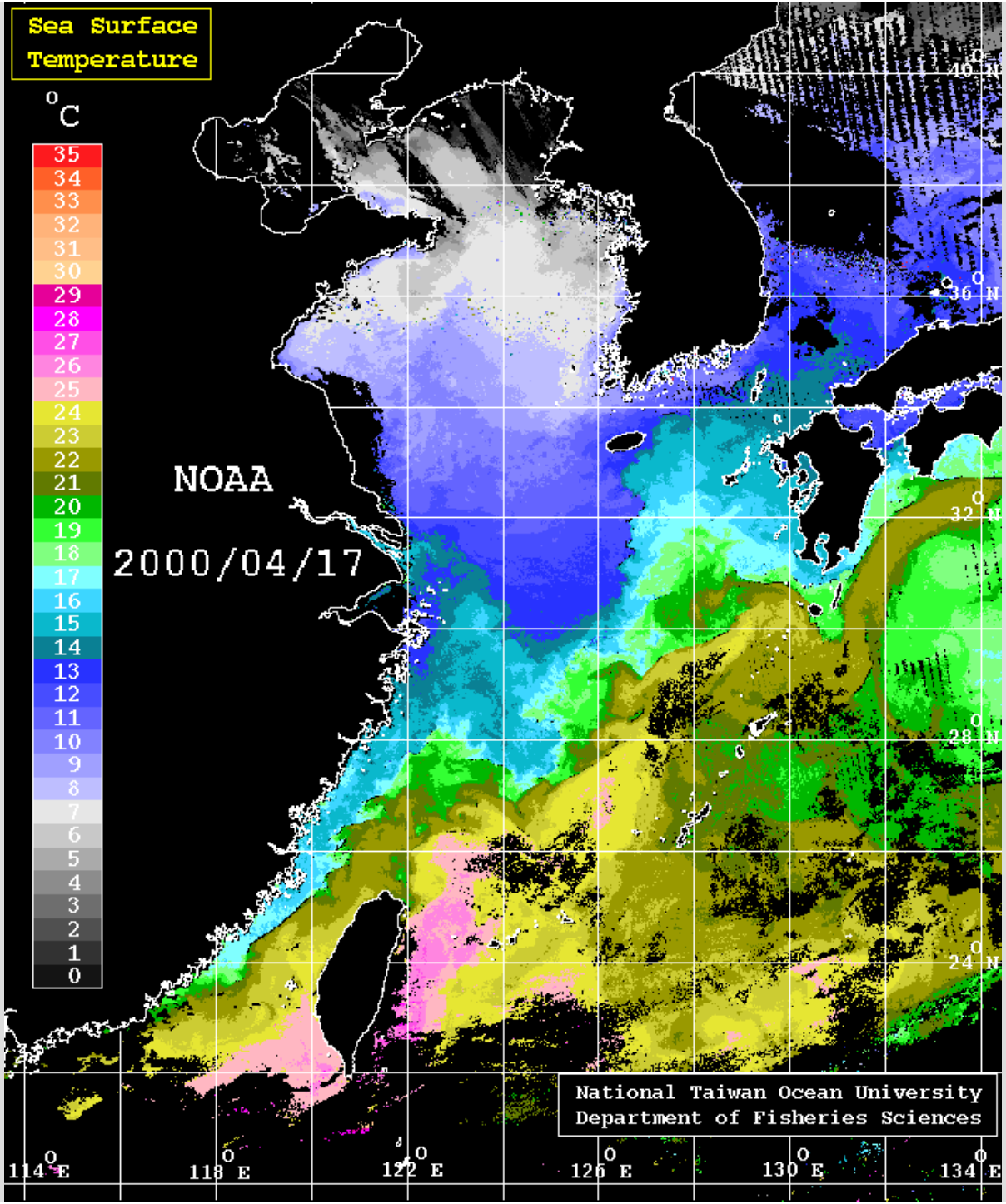
Bottom Topography of the East China Sea.

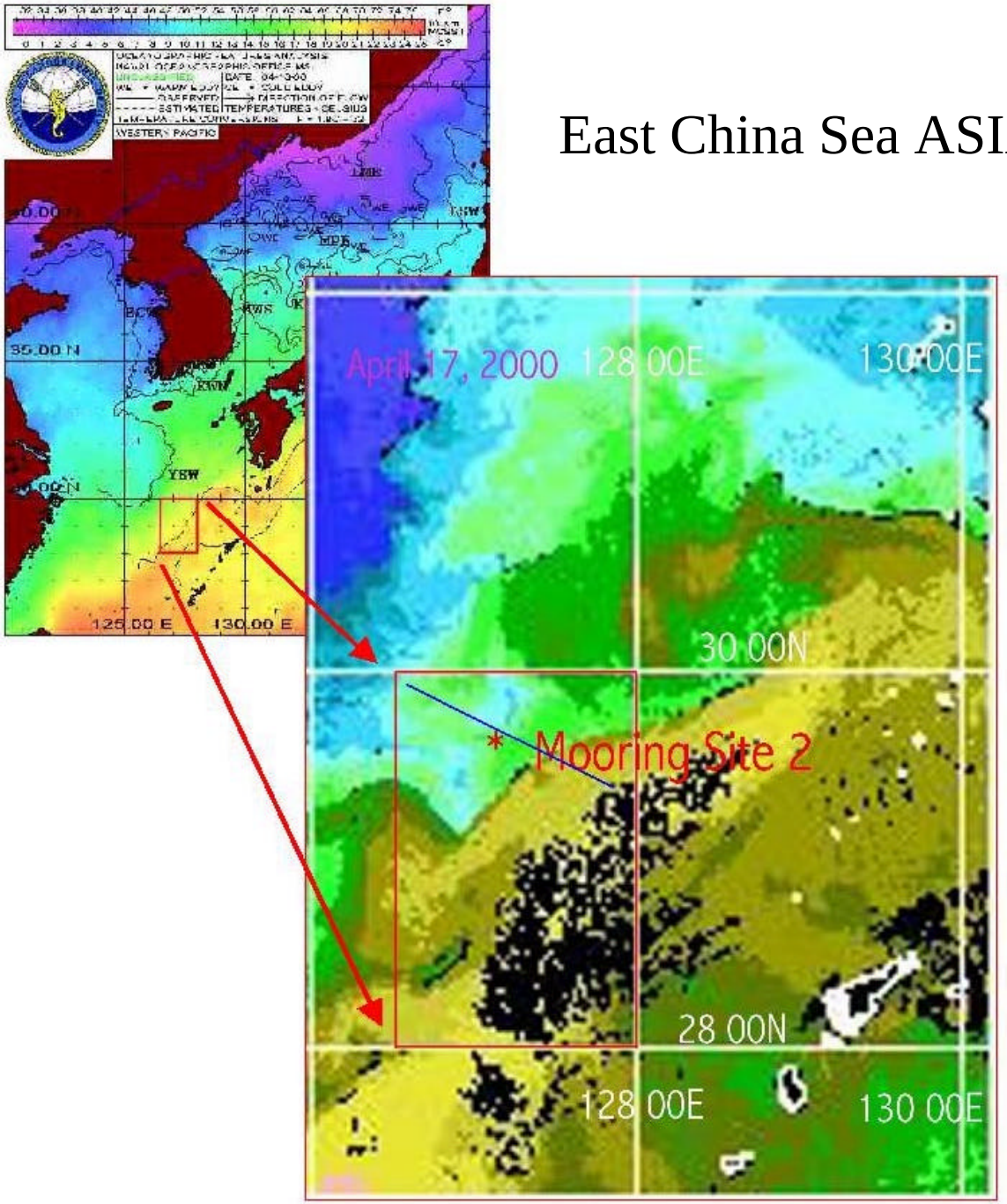
The ASIAEX study region is indicated





April 17, 2000

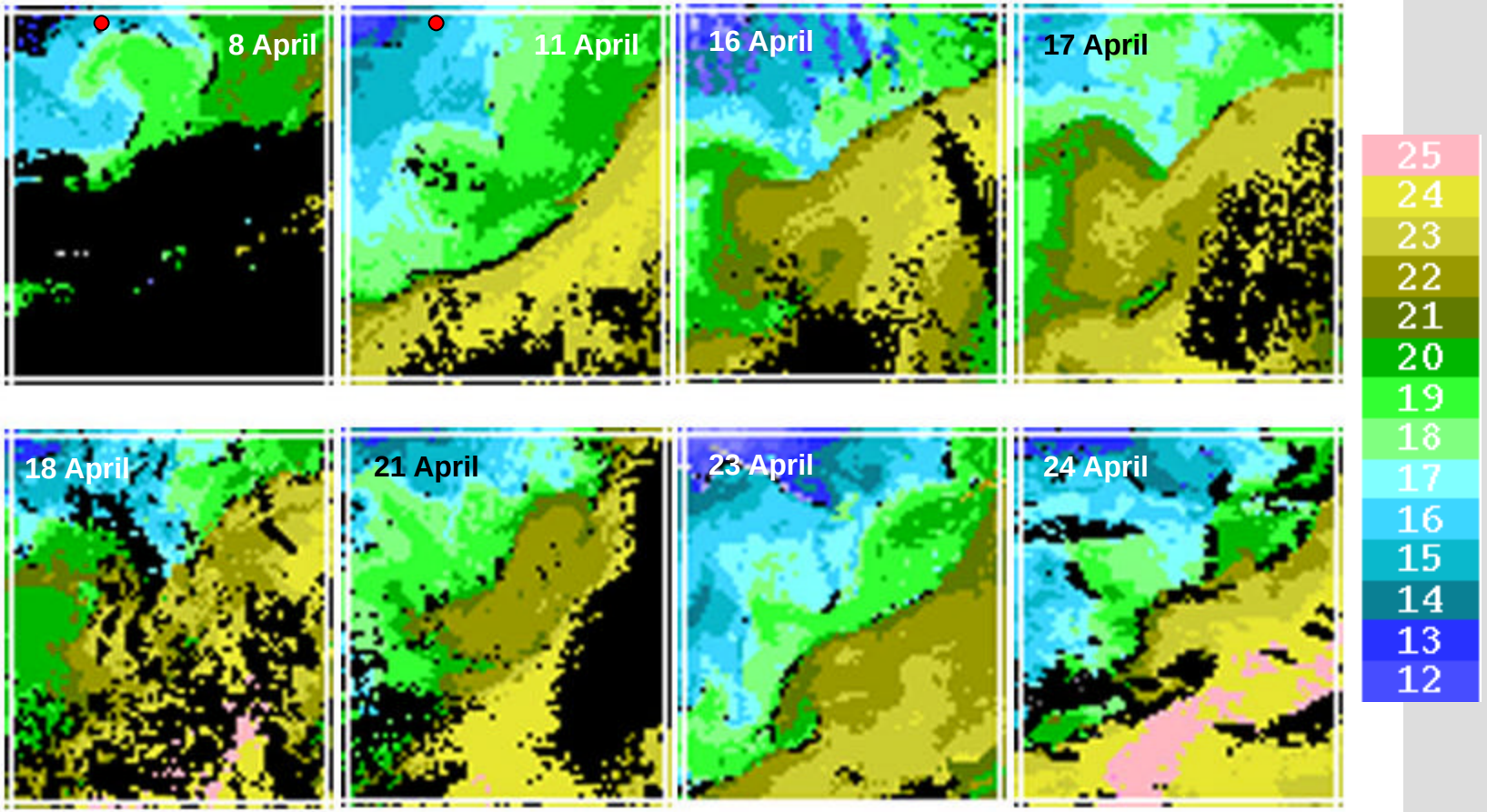
East China Sea ASIAEX Site Locator Map



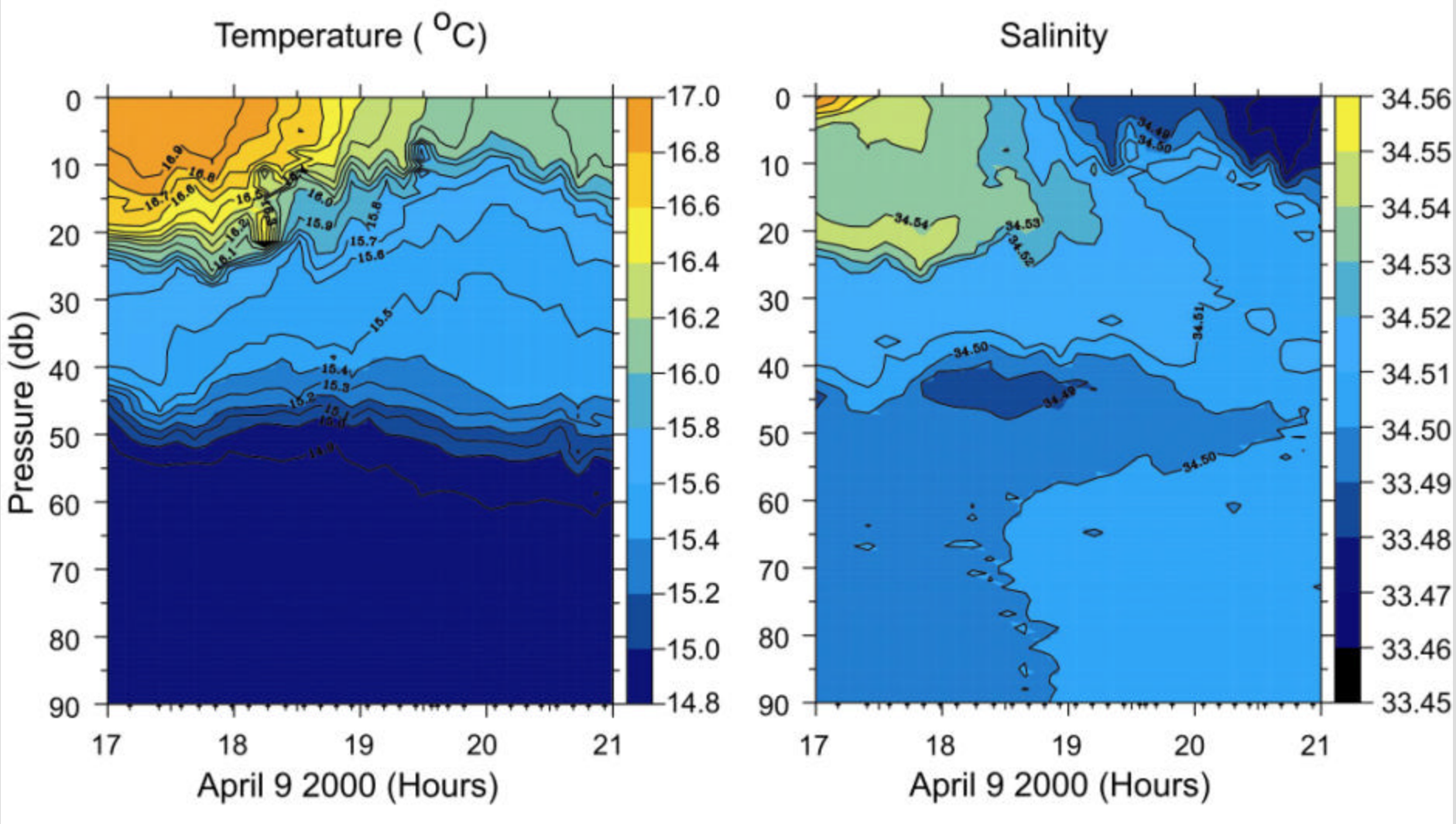
* Mooring Site

CTD Transect

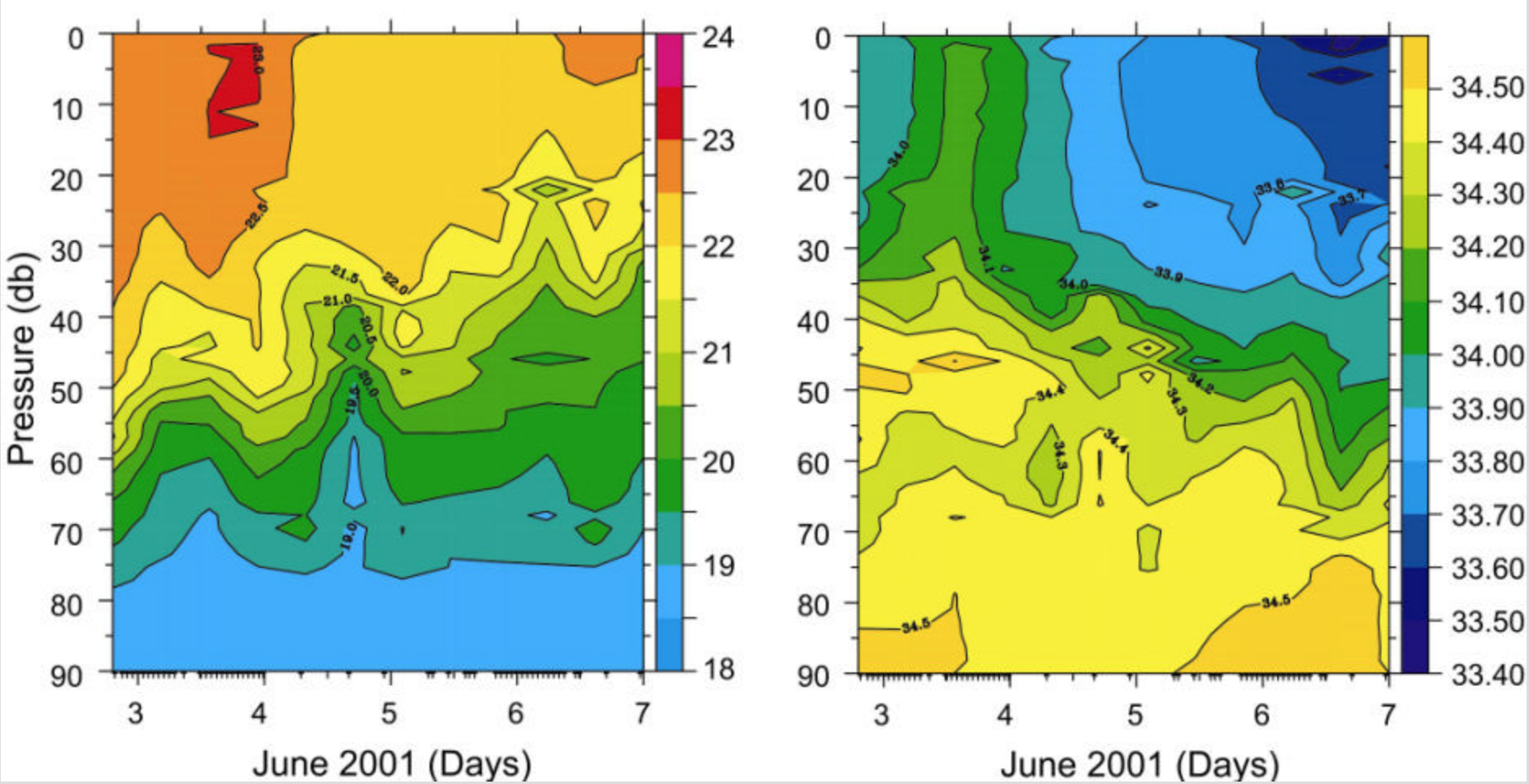
Frontal Movements During April 2000



Anchor Station Temperature and Salinity, April 2000



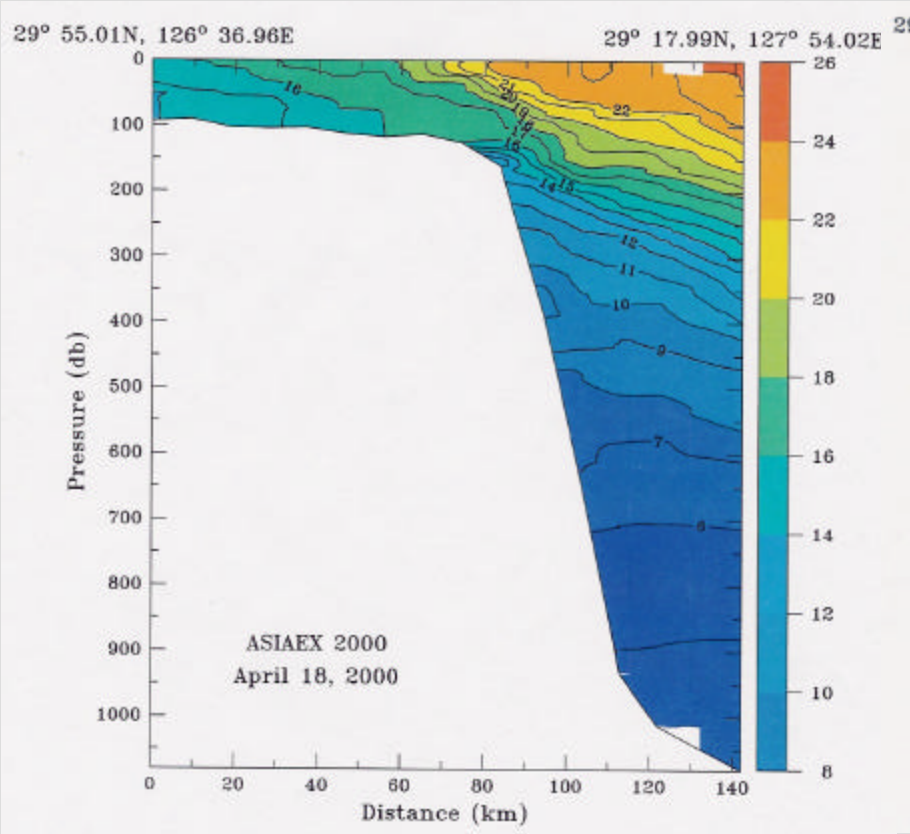
Anchor Station Temperature and Salinity, June 2001



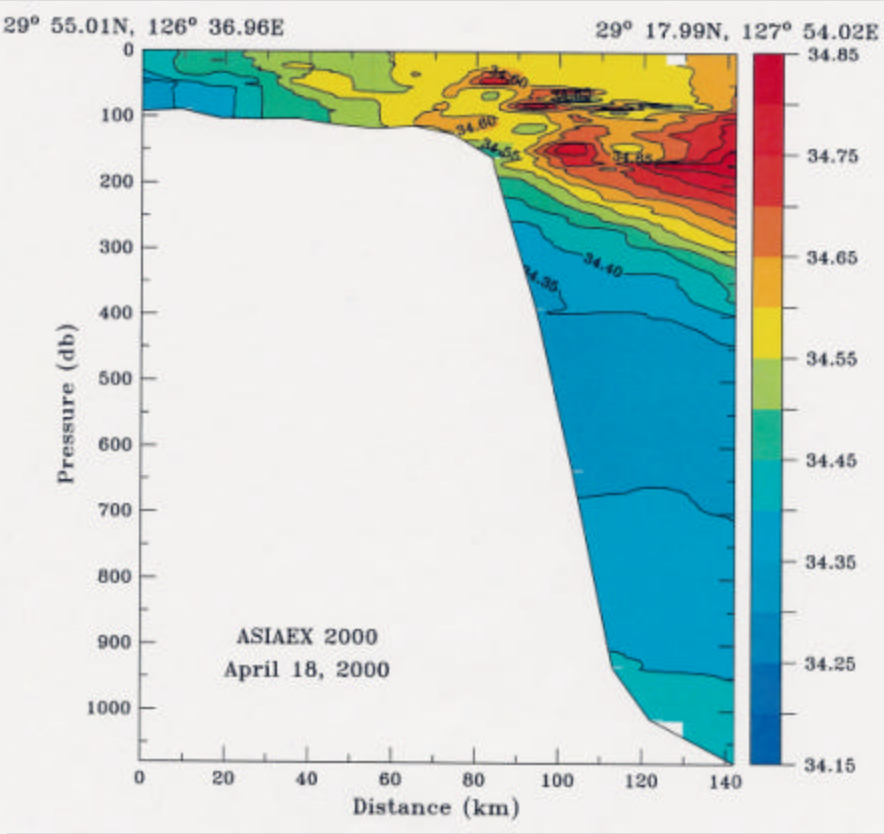
Across-Shelf Temperature and Salinity Sections

From the ASIAEX Pilot Study Cruise, April 2000

Temperature

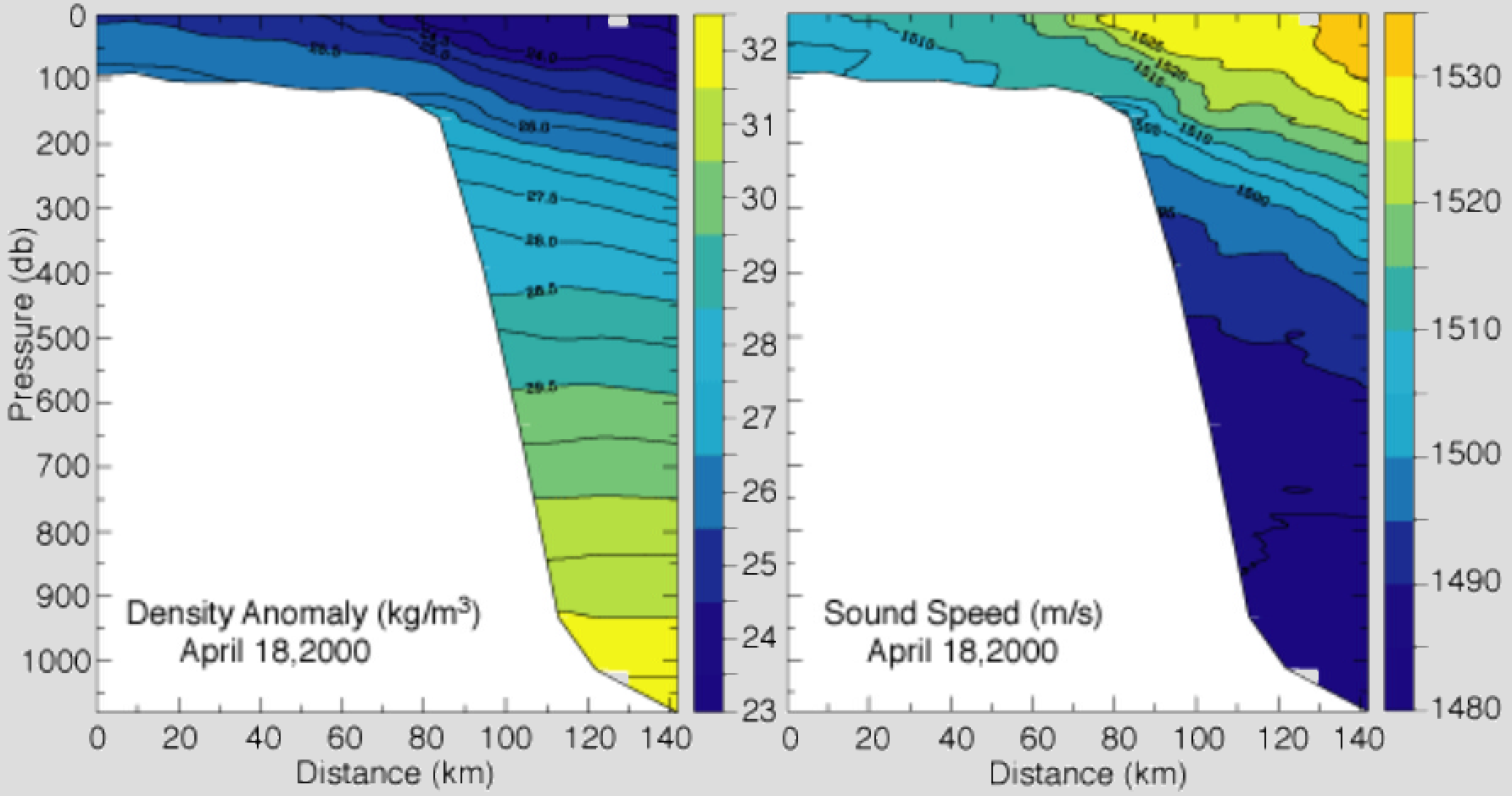


Salinity



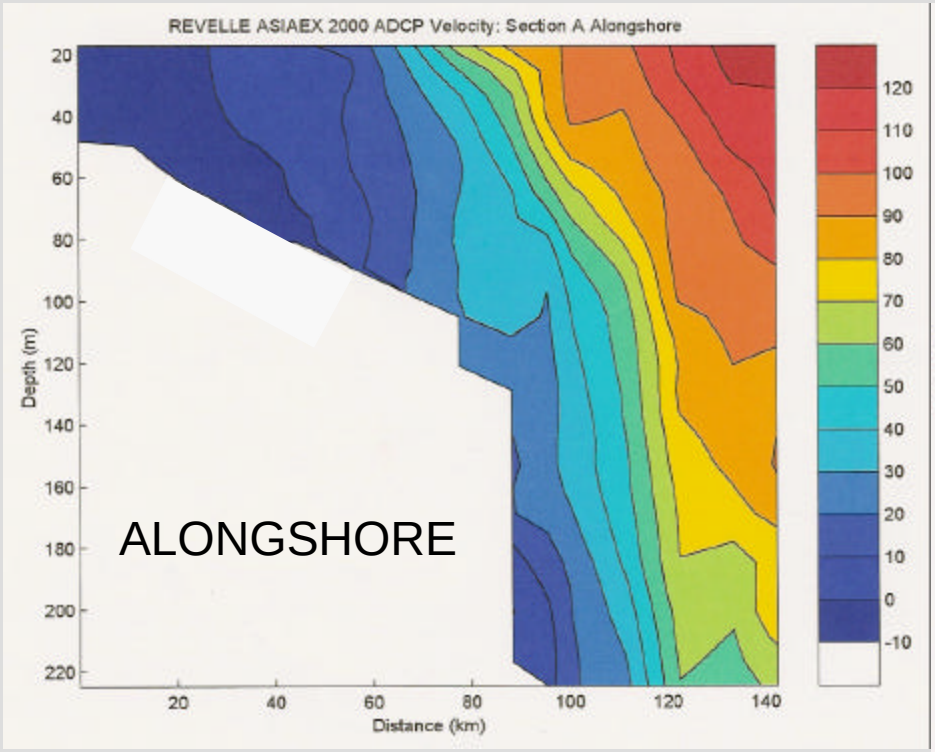
Across-Shelf Density and Sound Speed

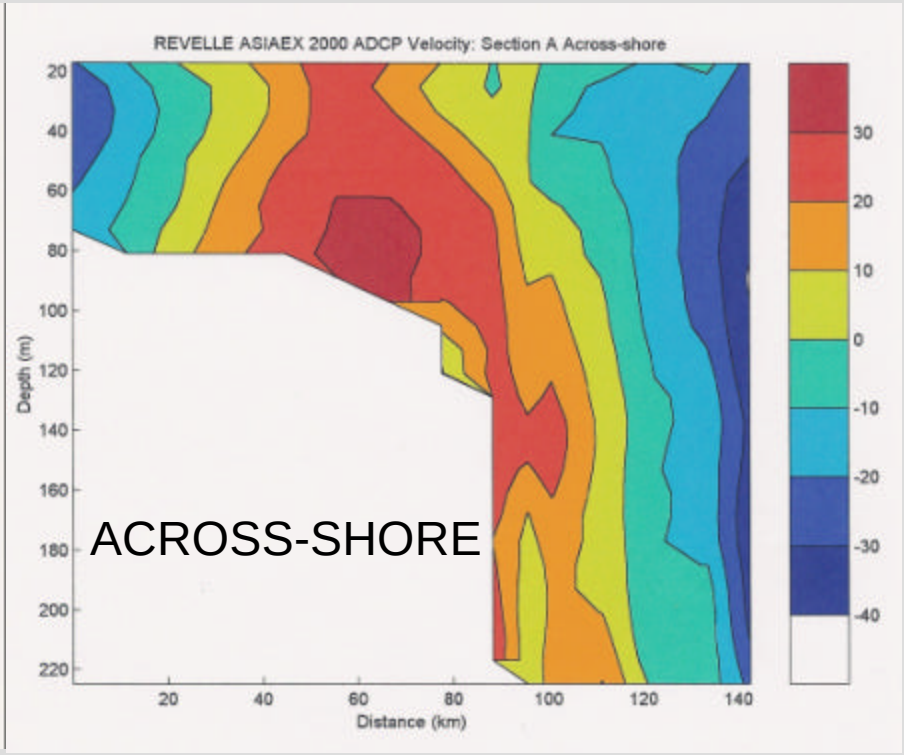
From the ASIAEX Pilot Study Cruise, April 2000



Along and Across-Shore ADCP Velocity Sections

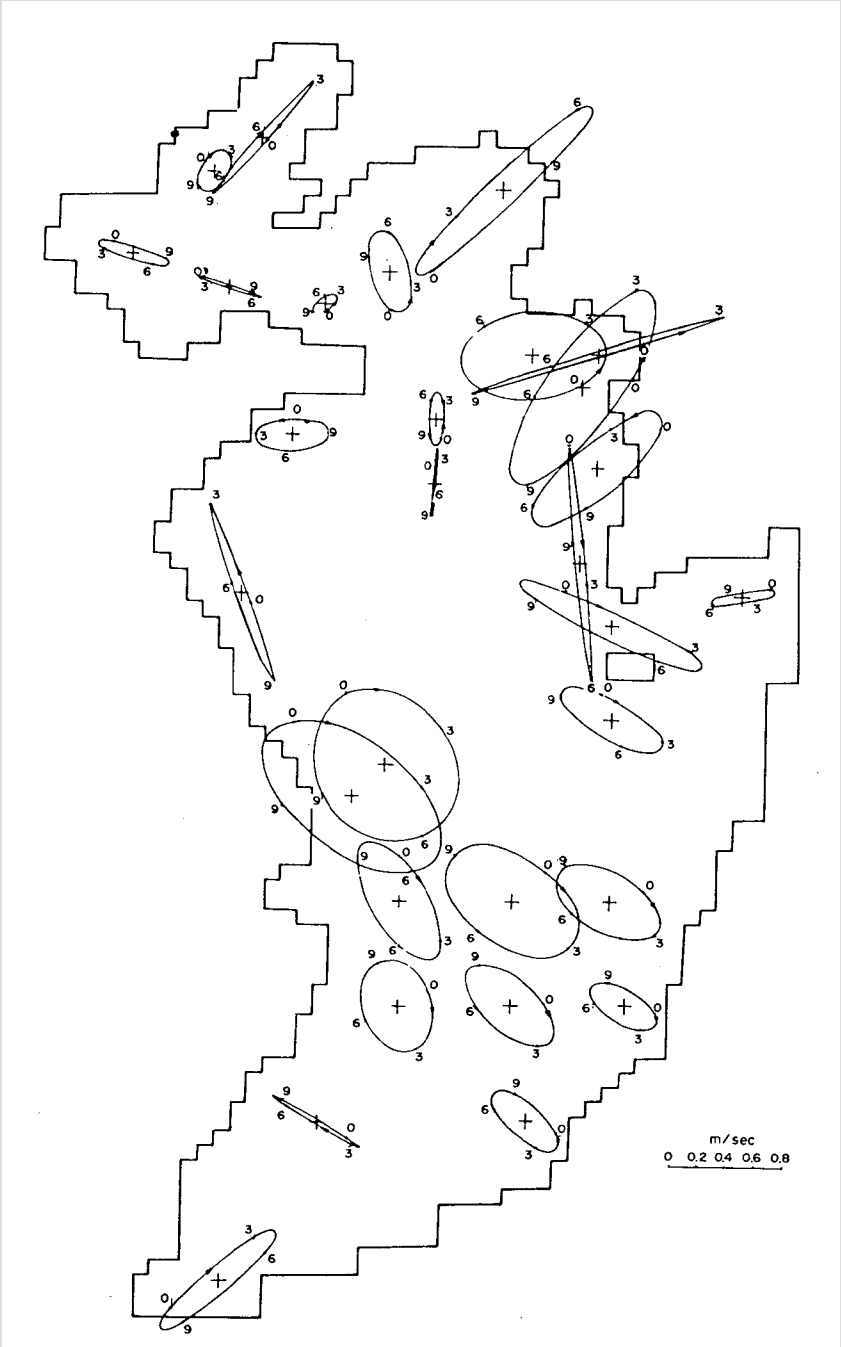
ASIAEX Pilot Study Cruise, April 2000





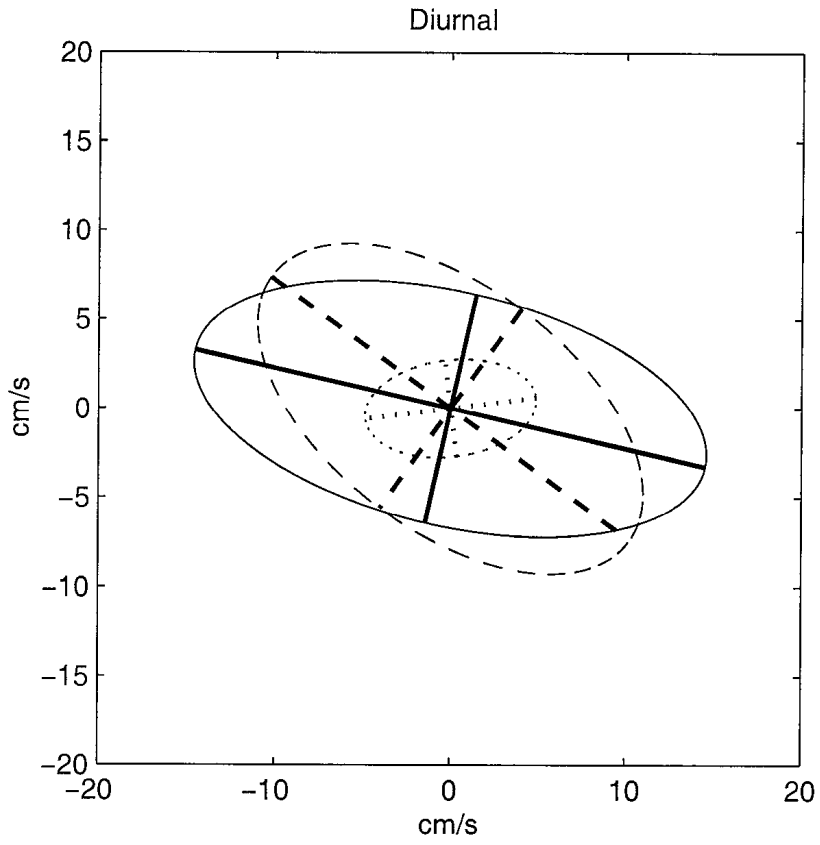
M2 (semidiurnal) Tidal Ellipses in the Yellow and East China Sea

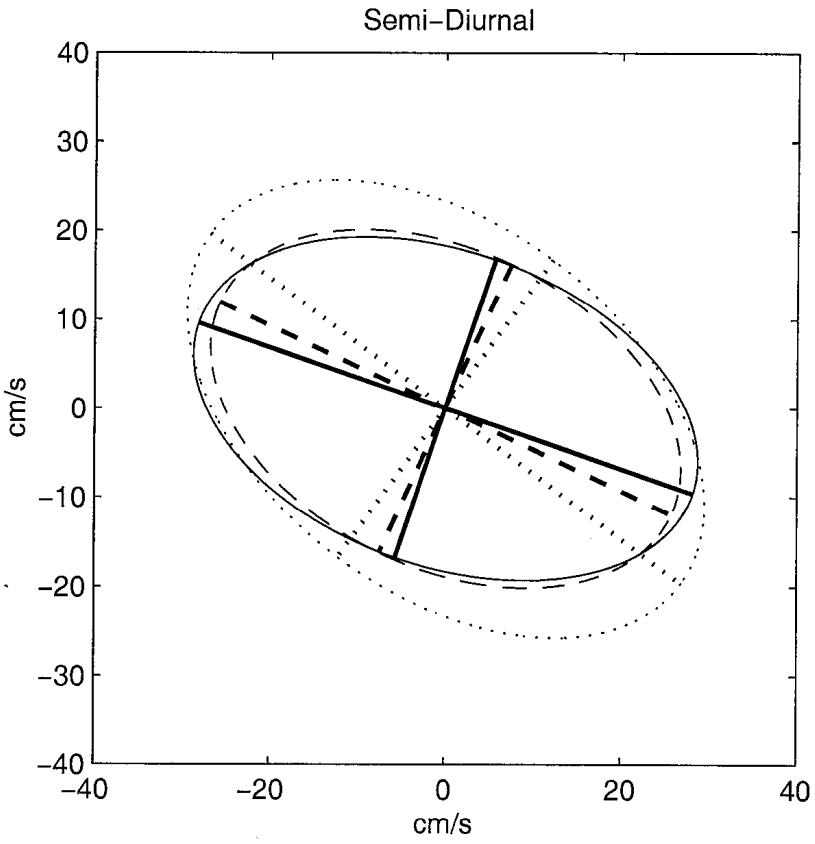
[from Larsen et al., 1985]



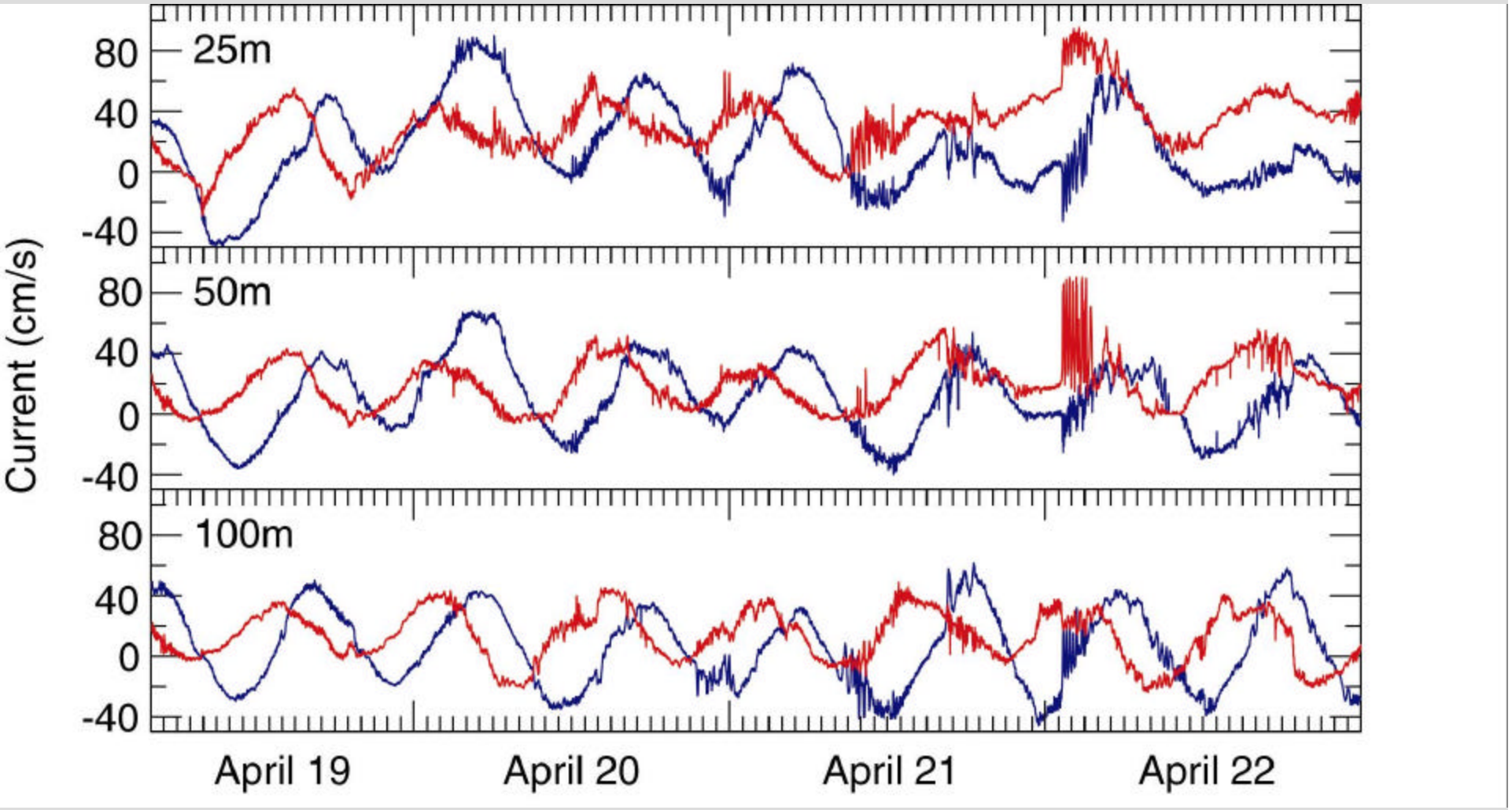
Tidal Ellipses

ASIAEX 2000 East China Sea Mooring

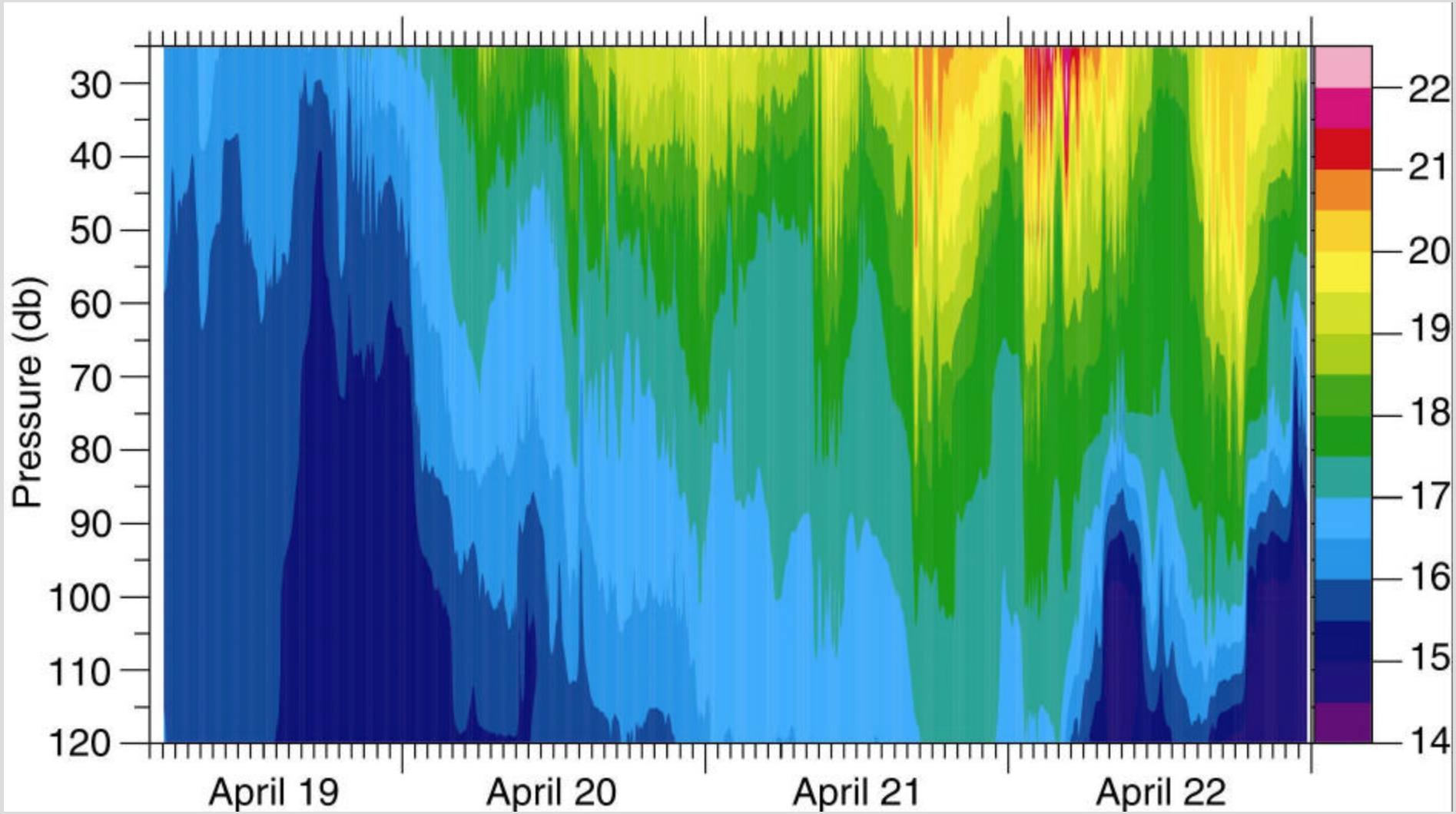




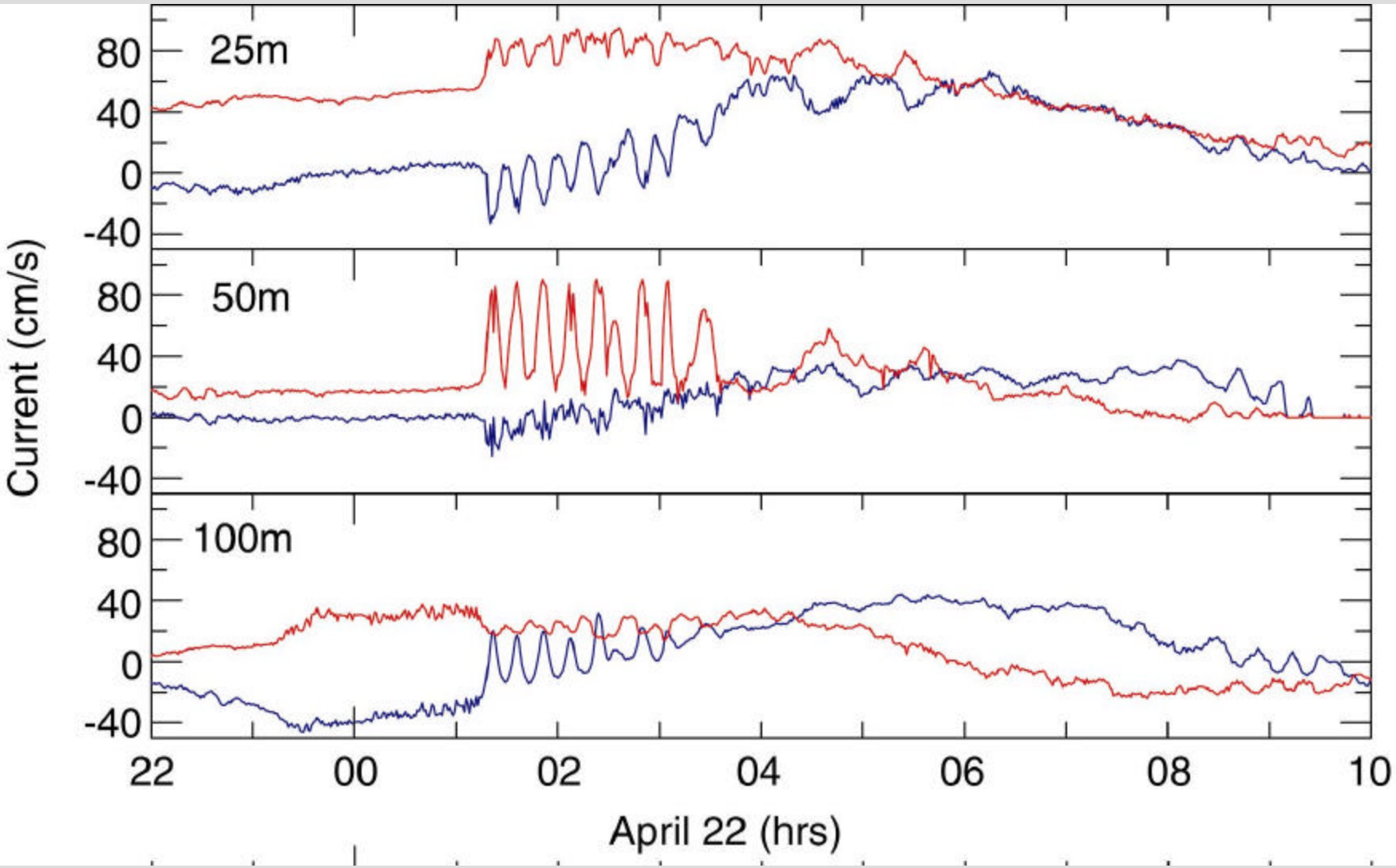
Alongshore (red) and Across-shore (blue) velocity components from the ASIAEX mooring, ECS Shelf



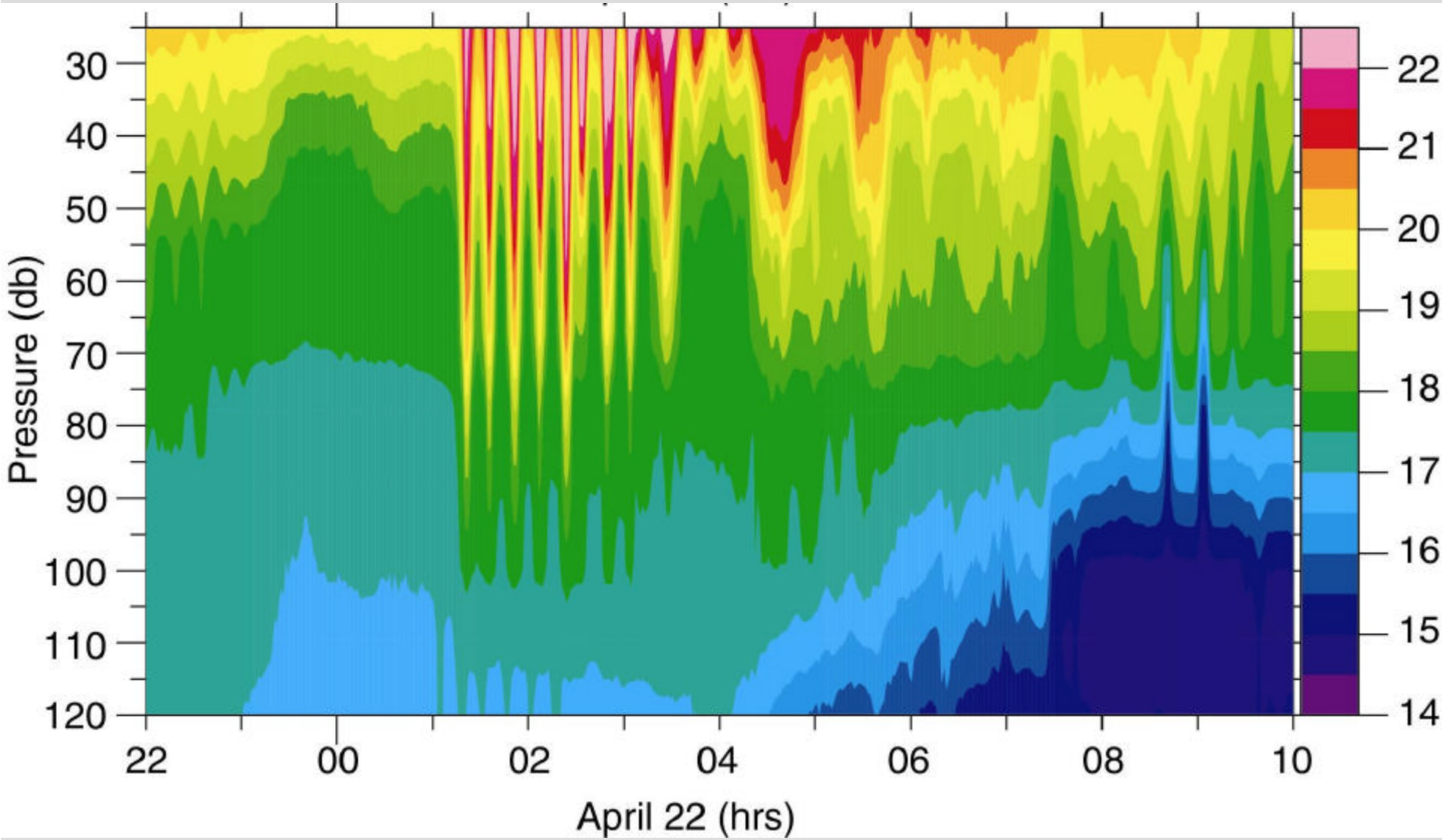
Temperature Data from ECS Shelf Mooring, 125 m Isobath



Expanded x-axis to show internal solitary waves



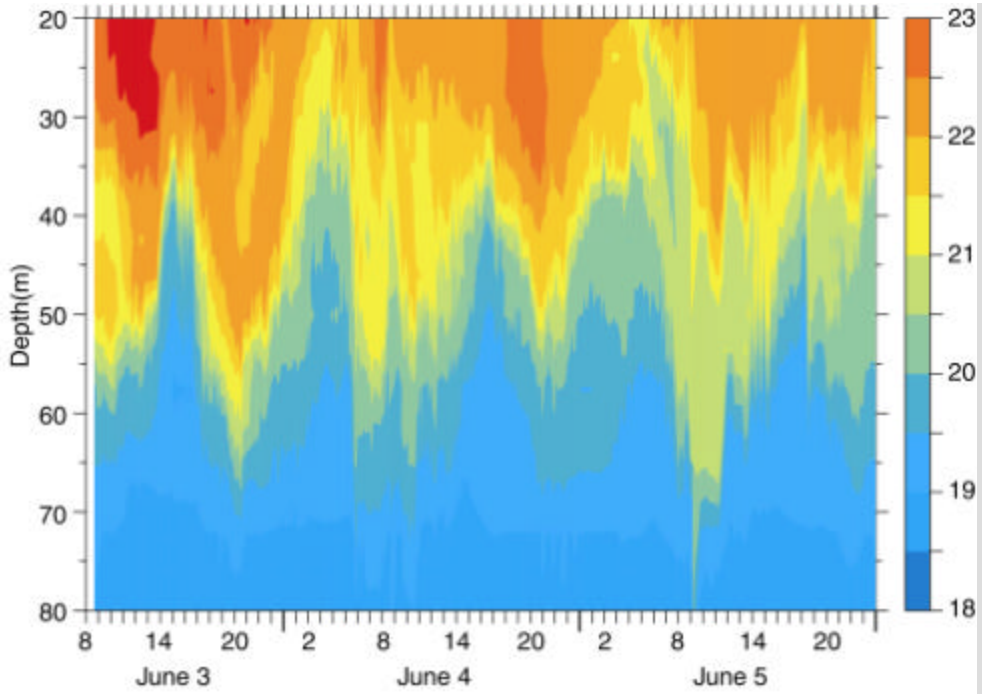
Corresponding Temperature Plot



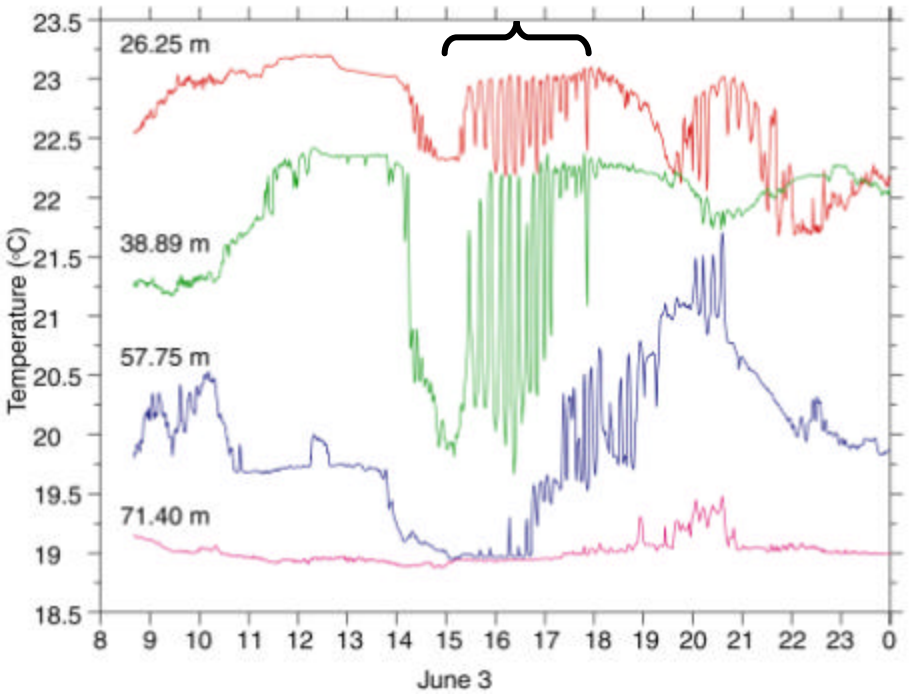
Properties of the ECS Soliton Packet

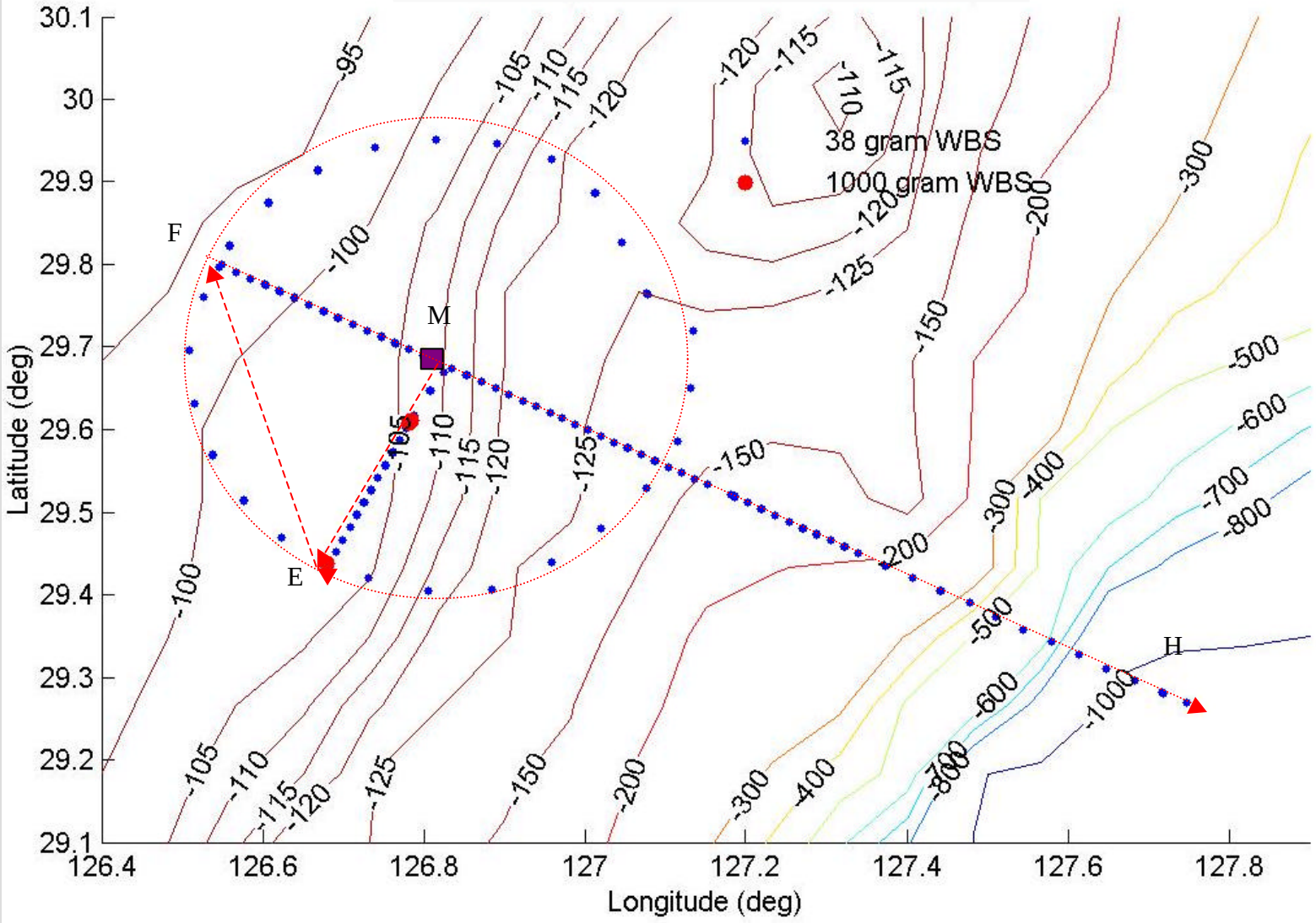
• Amplitude (η_0)	40 m
• Max Horizontal Current	70 cm s^{-1}
• Period (T)	15 min
• Phase Speed	83 cm s^{-1}
• Wavelength (λ)	500 – 800 m
• Half Width (L)	~300 m
• Number in Packet	8-9
• Total Packet Length	~7 km

ASIAEX June 2001 T-String Data



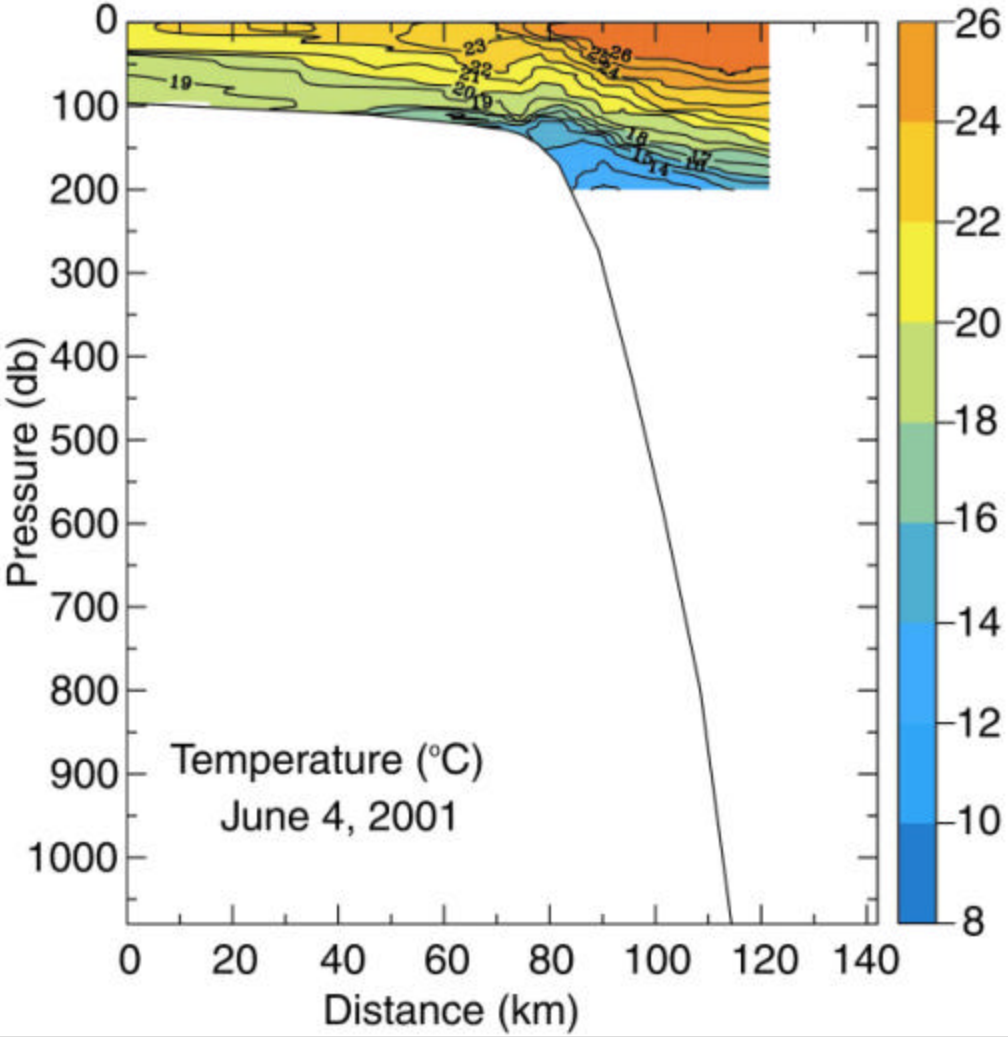
ORDINARY IW's

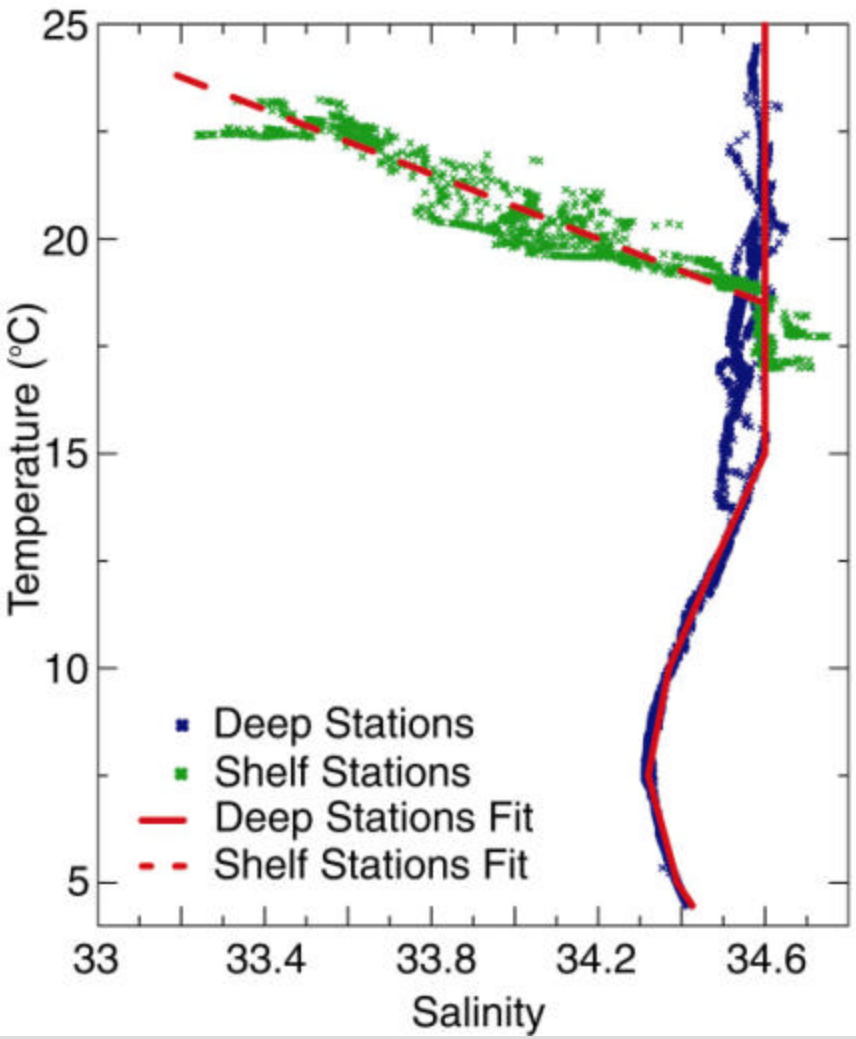




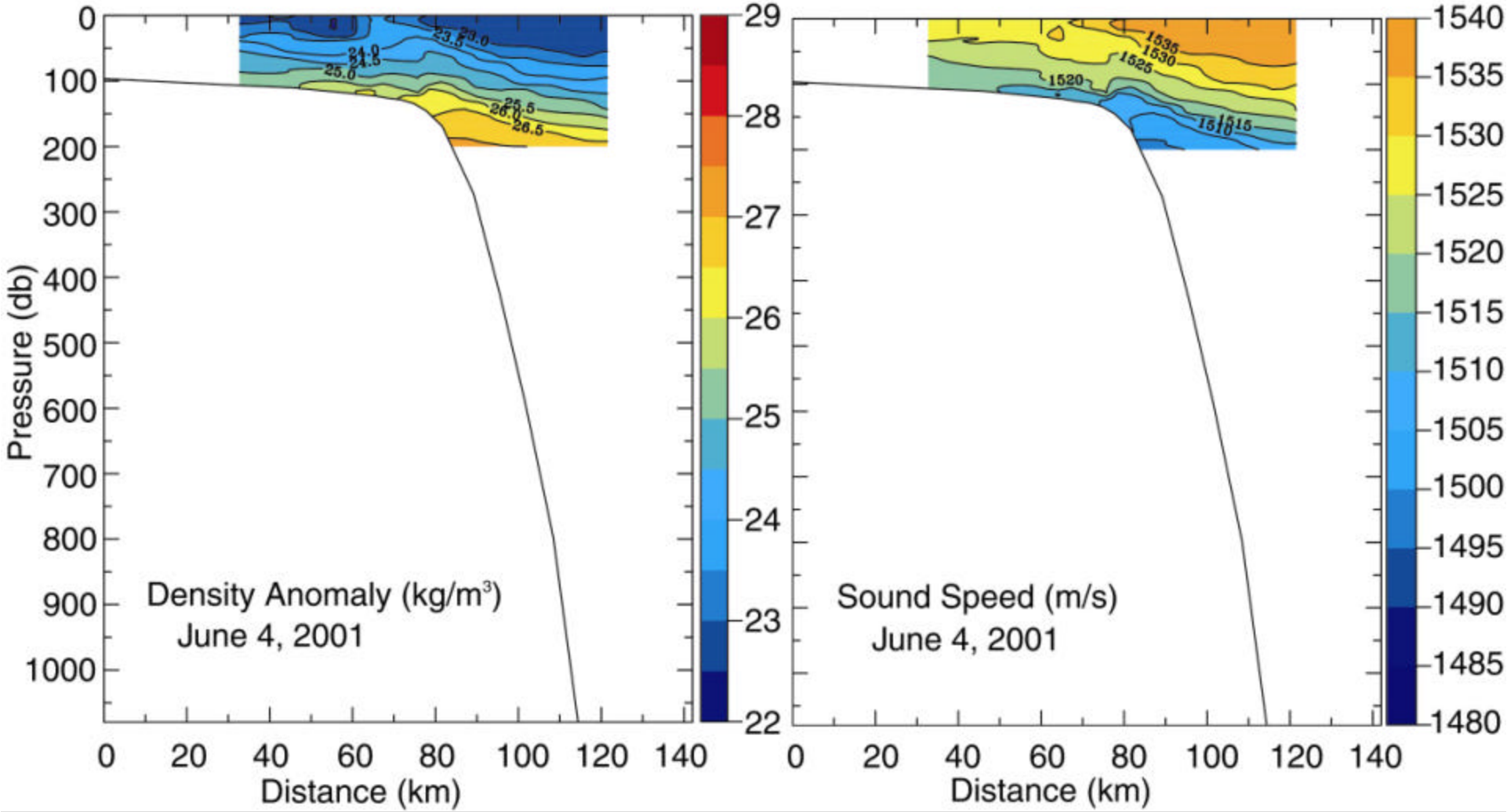
SHI YAN 2 WBS AND XBT DROP LOCATIONS

Synthesizing Sound Speed, June 2001

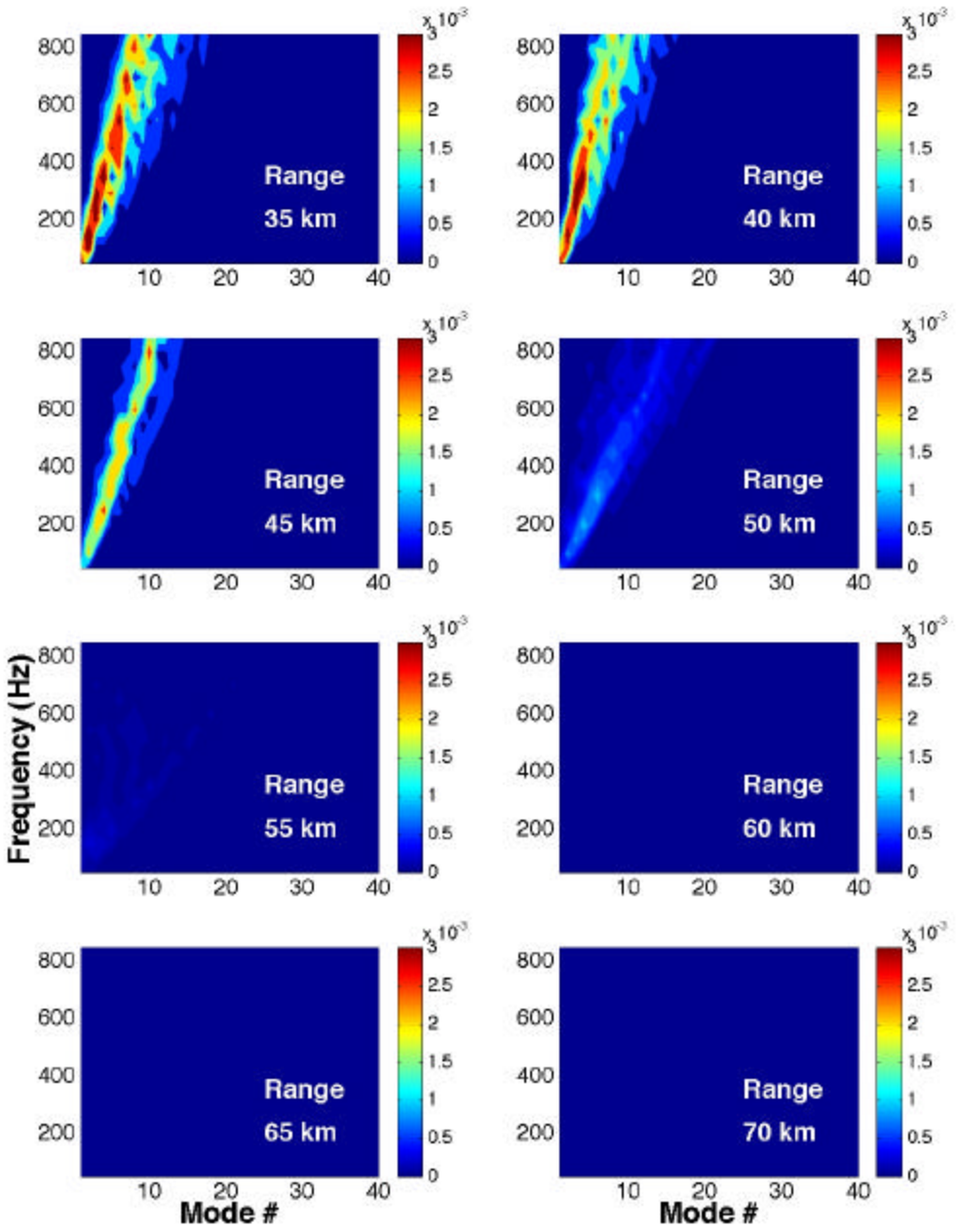




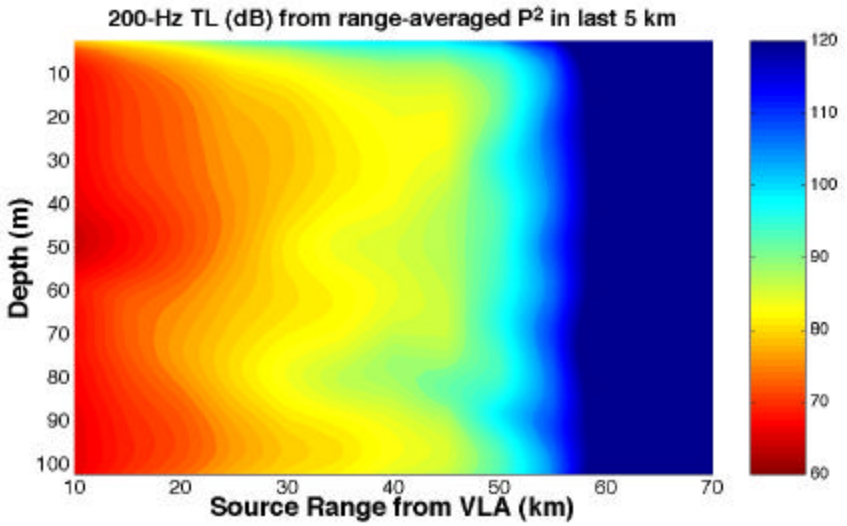
The Results

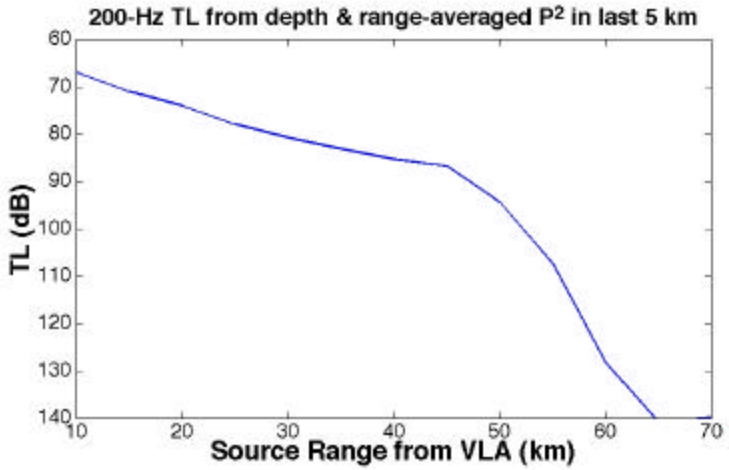

Pressure (db)
0
100
200
300
400
500
600
700
800
900
1000
Density Anomaly (kg/m³)
June 4, 2001
23.0
23.5
24.0
24.5
25.0
25.5
26.0
26.5
0 20 40 60 80 100 120 140
Distance (km)
29
28
27
26
25
24
23
22
Sound Speed (m/s)
June 4, 2001
1535
1530
1525
1520
1515
1510
0 20 40 60 80 100 120 140
Distance (km)
1540
1535
1530
1525
1520
1515
1510
1505
1500
1495
1490
1485
1480


ACOUSTIC IMPACTS:
East China Sea Frontal Effect:
Signal degradation in slope-to-shelf transmission

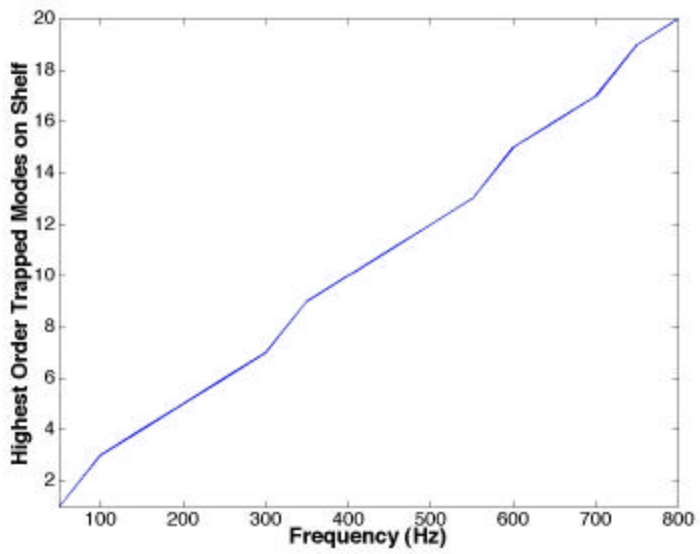


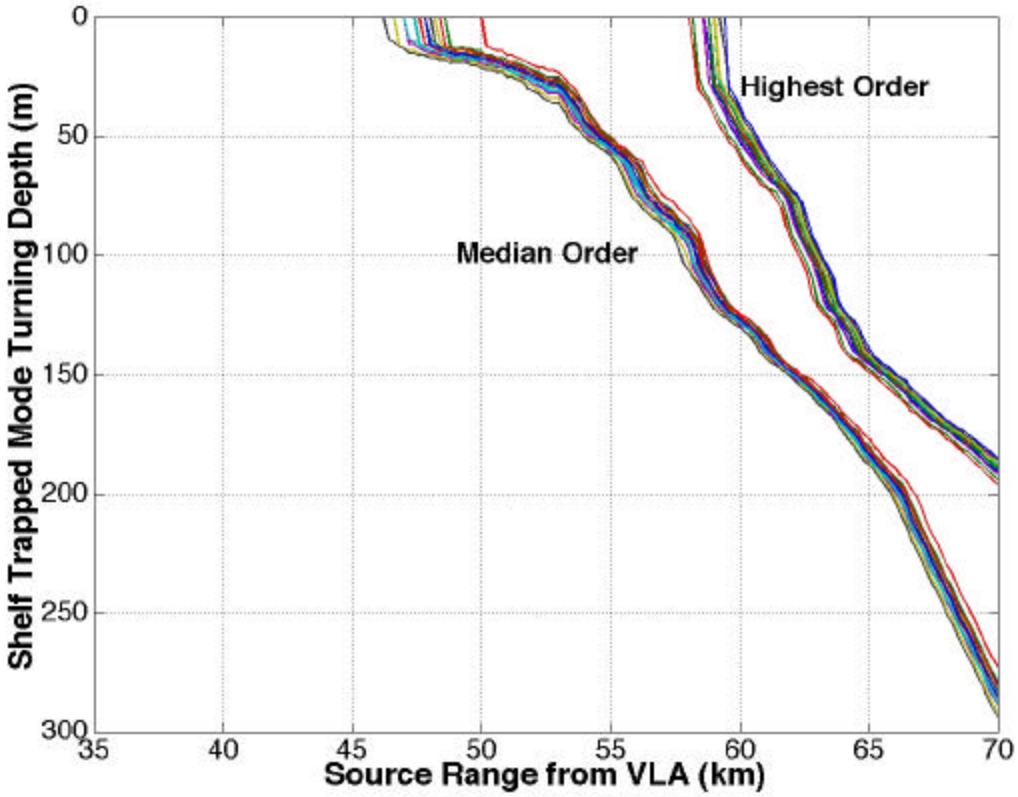
Modeled frequency-mode # distribution of signal magnitude at VLA location on the shelf (0 km) and its dependency on source range (positive seaward). Source depth was 50 m.



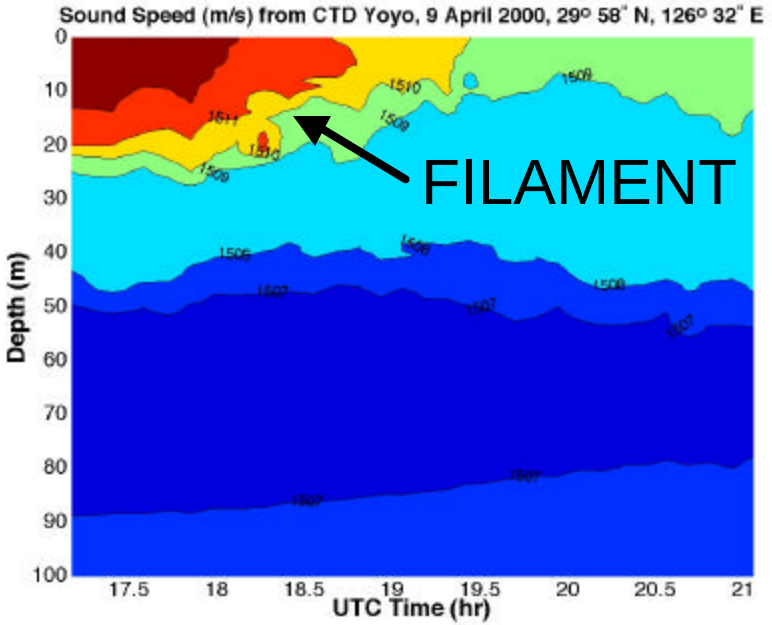


Modeled 200-Hz TL at VLA location (0 km) as a function of source range (positive seaward) for a source depth of 50 m.

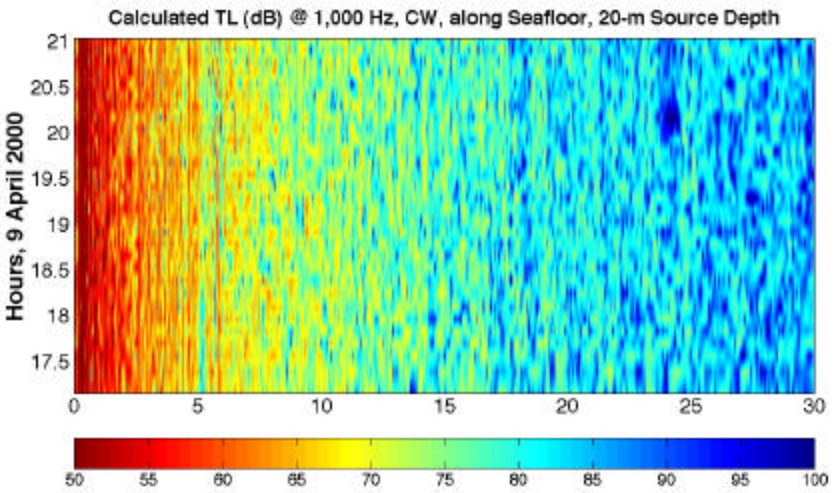


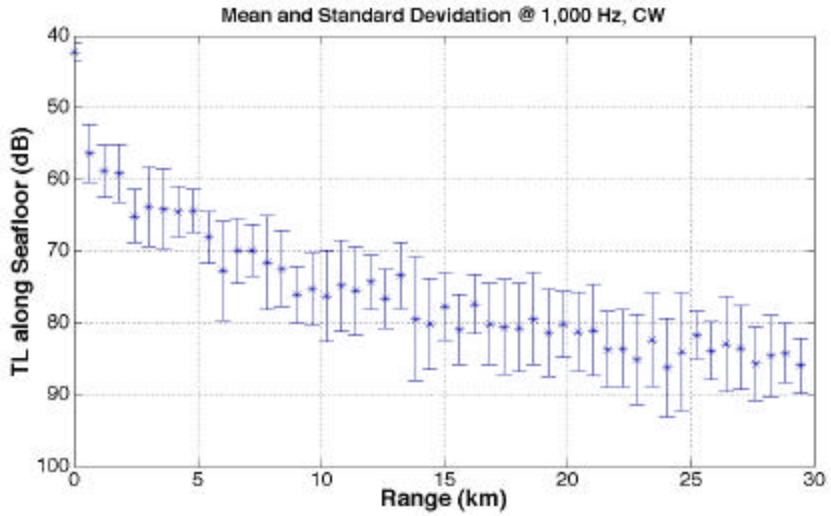


The maximum number of trapped modes on the shelf is shown on the left. These trapped modes begin to turn in the interior near the shelf edge (right) due to an increased down gradient. Note: No “shelf” trapped modes are excited if the source is placed above the turning depth of the highest-order trapped modes.

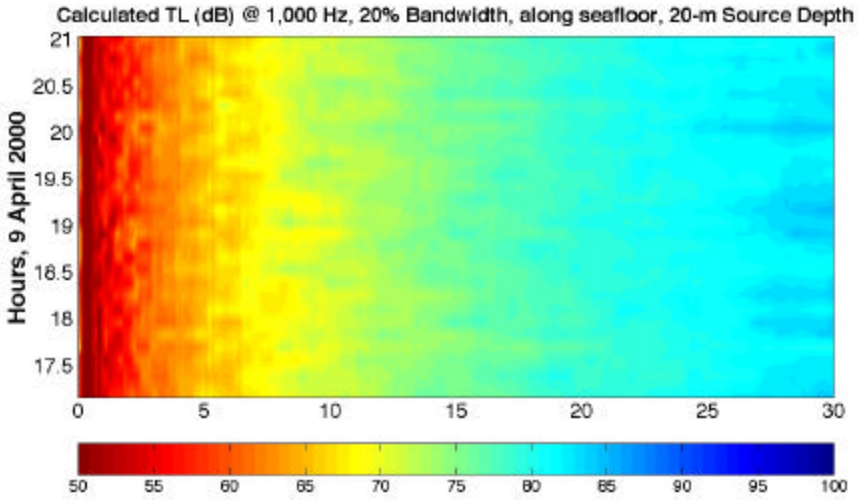


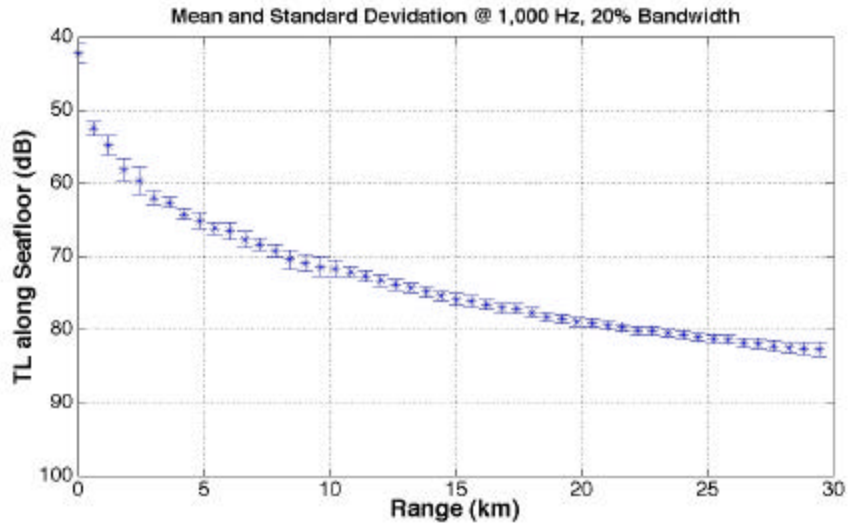
Sound Speed versus Time





Corresponding temporal fluctuations in the modeled TL for a CW transmission, showing large variances.





Corresponding temporal fluctuations in the modeled TL for a bandpass signal transmission, showing much reduced variances.

Summary

- The primary ocean feature of interest in the ASIAEX ECS region is the Kuroshio front
- Seasonal evolution of T/S structure to warmer/fresher in summer than spring
- Solitons not common, but may be generated under special conditions combining tidal and mesoscale motions
- Acoustic model across KS front can explain observed WBS propagation loss
- Small warm filament on shelf caused 5 db uncertainty in TL at 1 kHz along the bottom